

Revision of the Genus *Holcostethus* in North America (Hemiptera: Pentatomidae)

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Abstract: A diagnosis is given for the genus *Holcostethus* and descriptions are provided for six species. A new species is described from Arizona and a key is provided for the identification of all North American species.

Holcostethus is a widespread genus with representatives in North America, Europe, North Africa and Asia. The holarctic distribution of the genus is confirmed by the similarity of the seven North American species to the two European species examined, *H. sphaecelatus* (the type species) and *H. vernalis* (Figs. 4-17).

All the species examined have a pair of structures lying dorsally in the base of the pygophore that are unusual but not unique to the genus. These structures have been observed by many authors and given many names (Tuxen, 1970). Here they are termed pseudoclaspers.

Holcostethus Fieber, 1860

Holcostethus Fieber, 1860, Europ. Hem., p. 79; Kirkaldy, 1909, Cat. Hem., p. 47.

Peribalus Mulsant and Rey, 1866, Ann. Soc. Linn. Lyon (2) 14, p. 185; Stål, 1872, Ofv. Svenska Vet-Ak. Forh. 29 (3), p. 34; Distant, 1880, Biol. Cent. Amer. Het. 1, p. 65; Jakovlev, 1902, Ent. Obozr. 2, p. 158; Van Duzee 1904, Trans. Amer. Ent. Soc. 30, p. 32; Zimmer, 1912, Univ. Nebraska Studies 11, p. 221; Van Duzee, 1917, Cat. Hem., p. 32; Blatchley, 1926, Het. E. N. Amer., p. 105; Froeschner, 1941, Amer. Mid. Nat. 26, p. 127.

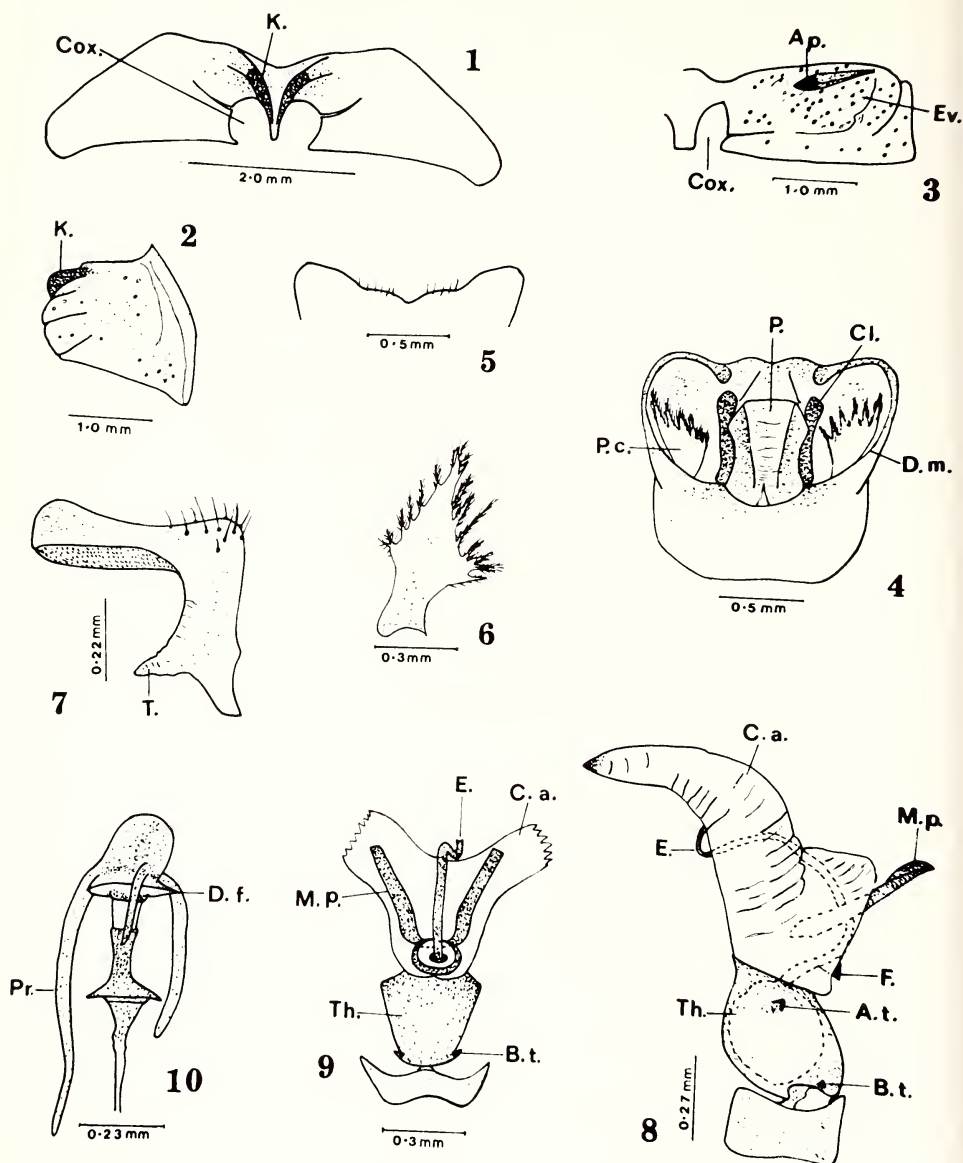
Dryocoris Mulsant and Rey, 1866, Ann. Soc. Linn. Lyon (2), 14 p. 190.

Type species: *Cimex sphaecelatus* Fabricius, 1794.

Diagnosis. Oval brown pentatomids ranging in size from 4-6 mm in width (across lateral angles) and 8-10 mm long (tip of head to membrane apex). *Head.* Jugae slightly longer

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I am especially grateful to Professor L. H. Rolston, Entomology Department, Louisiana State University, for suggesting this study and for the use of material and notes he had made on this genus. I am also indebted to him for reading and correcting the manuscript.



FIGS. 1-10. *H. sphacelatus*. 1. Prosternum. 2. Prosternum, lateral view. 3. Metasternum. 4. Pygophore, dorsal view. 5. Ventral margin of pygophore. 6. Right pseudo-clasper. 7. Right clasper. 8. Aedeagus, lateral view. 9. Aedeagus, ventral view. 10. Spermathecal bulb and pump, stink gland opening and sulcus (A. p.), apical tubercle (A. t.), basal tubercle (B. t.), conjugal appendage (C. a.), clasper (Cl.), coxal cavity (Cox.), distal flange of pump (D. f.), dorsal margin (D. m.), endophallic duct (E.), evaporative area (Ev.), flange (F.), keel (K.), median penial lobe (M. p.), proctiger (P.), pseudo-clasper (P. c.), process (Pr.), tubercle (T.), theca (Th.).

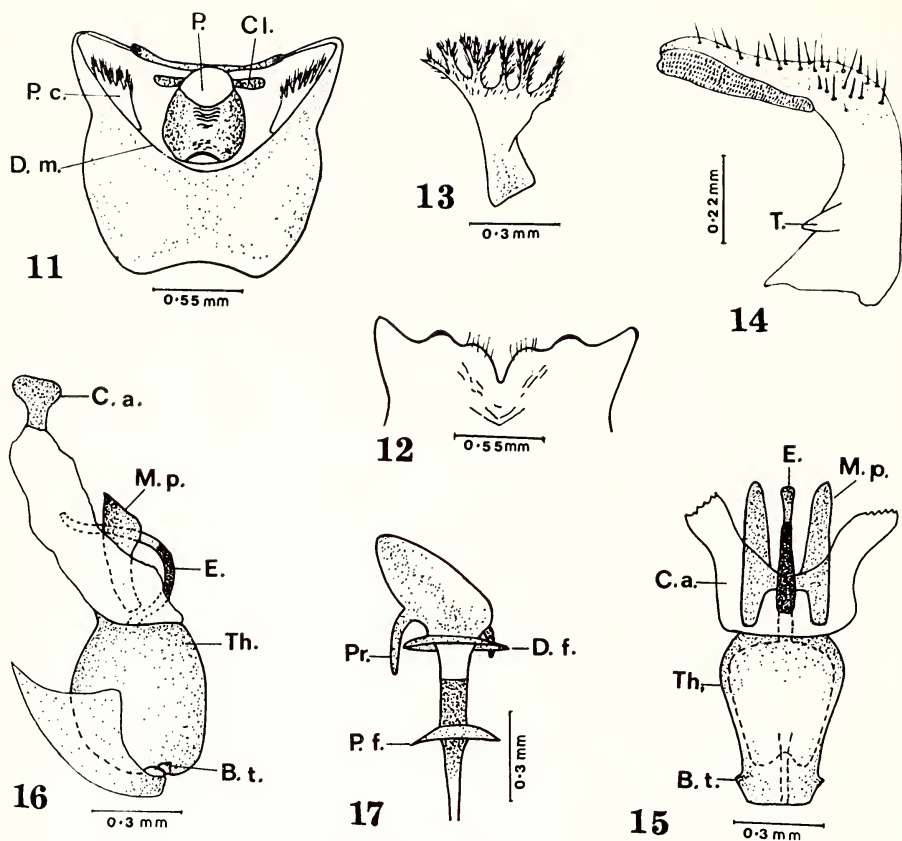
than tylus, generally convergent apically, in some species meeting completely around tylus. Apex of rostrum generally reaching hind coxae. *Thorax*. Pronotum trapezoidal, deflexed between anterolateral margins. Scutellum extending two-thirds way down abdominal terga, apex narrowing beyond frena and bluntly rounded. Prosternum with two distinct keels forming a V between the coxal cavities (Figs. 1, 2). Metasternum with large granulose evaporative areas (Fig. 3); odoriferous gland openings with a long sulcus. *Abdomen*. Females generally with connexiva visible beyond folded hemelytra; males with connexiva covered by folded hemelytra.

Male genitalia. Pygophore with a pair of palmate pseudoclaspers, one on either side (Figs. 4, 6). Claspers L-shaped with a large basal tubercle (Fig. 7). Theca well-sclerotized with a pair of basal and apical tubercles, latter absent in one species (Fig. 8). One pair of conjunctival appendages present. Median penal lobes paired, plate-like, apically acute, united at base on either side of S-shaped endophallic duct (Fig. 9).

Female genitalia. External genitalia plate-like; eighth paratergites without spiracles; ninth paratergites oblong, well-separated (Fig. 26). Spermatheca typically pentatomoid; spermathecal bulb with 2 or 3 fingerlike processes (Fig. 10).

KEY TO THE SPECIES OF *HOLCOSTETHUS* IN N. AMERICA

1. Ventral surface of abdomen dark chocolate brown, margins may be outlined in yellow 2
 Ventral surface of abdomen either yellow or buff or reddish brown, with or without black markings 5
2. Long gray setae found on dorsal surface especially on pronotum
 *hirtus* (Van Duzee)
 Dorsal surface without conspicuous setae 3
3. Scutellum with distinct yellow tip; anterolateral margins of prothorax straight or slightly concave; ventral margin of pygophore as in Fig. 38; theca lacking apical tubercles *piceus* (Dallas)
 Scutellum concolorous or with very faint white tip; anterolateral margins of prothorax convex; theca with apical tubercles 4
4. Small species, not more than 7.5 mm long (apex of head to tip of membrane) and 4.0 mm wide (between lateral angles of pronotum); ventral border of pygophore with a small protuberance below median notch (Fig. 53)
 *ruckesi* McDonald
 Larger species, over 7.5 mm long and 4.0 mm wide; ventral border of pygophore without protuberance (Fig. 46) *tristis* (Van Duzee)
5. Reddish brown species with distinctive zig-zag black markings on ventral surface of abdomen; jugae not meeting in front of tylus; restricted to E. States *fulvipes* (Ruckes)
 Brown colored species without distinctive markings on abdomen 6
6. Anterolateral margins of pronotum convex, submarginally impressed; connexiva with distinctly alternating pattern of yellow and black along margins (Fig. 19). Ventral border of pygophore as in Fig. 21; dorsal border bearing a large pair of spines (Fig. 20) *abbreviatus* Uhler
 Anterolateral margins of pronotum straight or slightly concave (Fig. 29); connexival margin entirely yellow (Fig. 30); ventral border of pygophore as in Fig. 31; dorsal border without spines *limbolarius* (Stål)



FIGS. 11-17. *H. vernalis*. 11. Pygophore, dorsal view. 12. Ventral margin of pygophore. 13. Left pseudoclasper. 14. Left clasper. 15. Aedeagus, ventral view. 16. Aedeagus, lateral view. 17. spermathecal bulb and pump, basal tubercle (B. t.) conjunctival appendage (C. a), clasper (Cl.), dorsal margin (D. m.), endophallic duct (E.), median penal lobe (M. p.), proctiger (P.), pseudoclasper (P. c.), tubercle (T.), Theca (Th.)

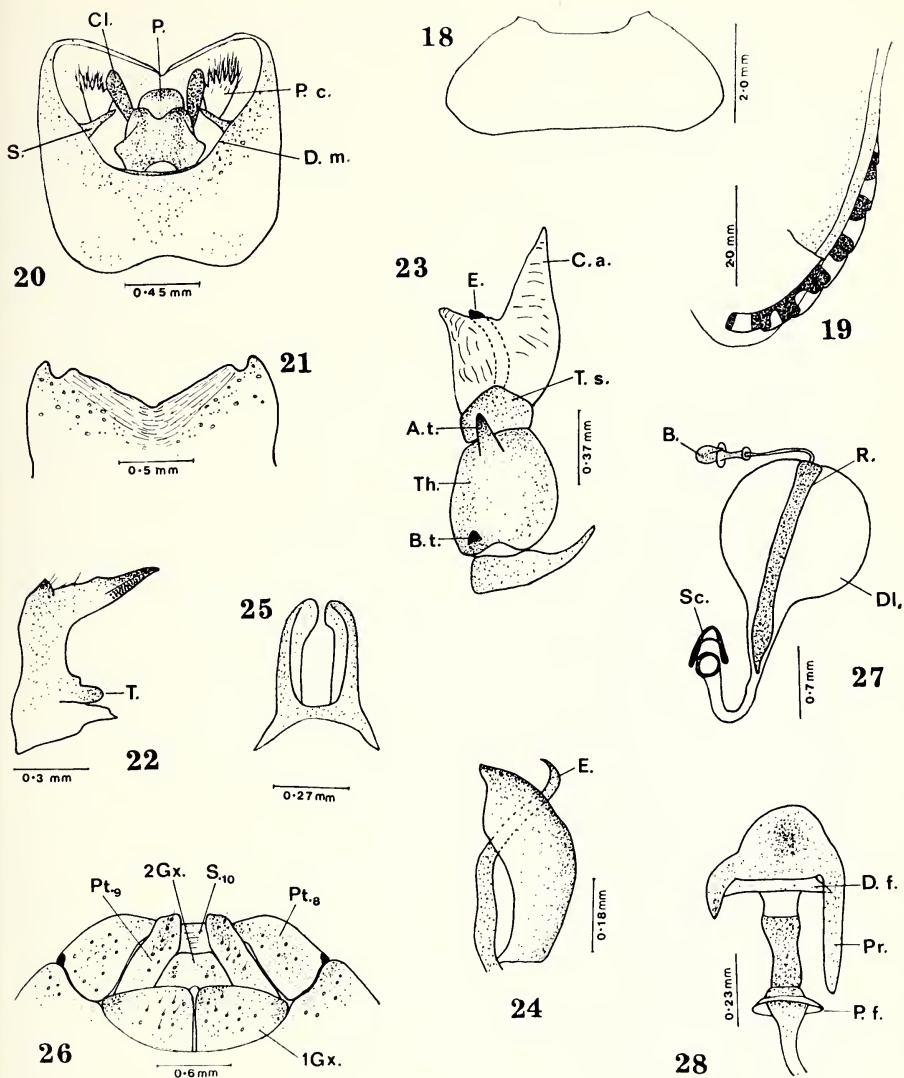
Holcostethus abbreviatus Uhler, 1872

Holcostethus abbreviatus Uhler, 1872, Prelim. Rep. U.S. Geol. Surv. Mont., p. 397; Uhler, 1876, Bull. U.S. Geol. Surv. 1, p. 289; Uhler, 1877, Bull. U.S. Geol. Surv. 3, p. 403; Uhler, 1895, Proc. Calif. Acad. Sci. (Ser. 2) 4, p. 230; Gillette and Baker, 1895, Hem. Colo., p. 16; Kirkaldy, 1909, Cat. Hem., p. 47.

Peribalus abbreviatus Van Duzee, 1904, Trans. Amer. Ent. Soc. 30, p. 33; Snow, 1906, Trans. Kan. Acad. Sci. 20(1), p. 177; Zimmer, 1912, Univ. Nebr. Stud. 11, p. 224; Van Duzee, 1917, Cat. Hem., p. 32.

Peribalus eatoni Bliven, 1960, Occ. Ent. 1, p. 36.

Jugae meeting in front of tylus. Anterolateral margins of pronotum distinctly bowed out and submarginally impressed (Fig. 18). Anterior face of pronotum very slightly sloping.



FIGS. 18–28. *H. abbreviatus*. 18. Pronotum. 19. Lateral margin of abdomen, dorsal view. 20. Pygophore. 21. Ventral margin of pygophore. 22. Left clasper. 23. Aedeagus, lateral view. 24. Right median penal lobe, lateral view. 25. Median penal lobes, ventral view. 26. Female genitalia. 27. Spermatheca. 28. Spermathecal bulb and pump, apical tubercle (A. t.), spermathecal bulb (B.), basal tubercle (B. t.), conjunctival appendage (C. a.), clasper (Cl.), distal flange (D. f.), dorsal margin (D. m.), dilation of spermathecal duct (Dl.), endophallic duct (E.), first gonocoxae (1 Gx.), second gonocoxae (2 Gx.), median penal lobe (M. p.), proctiger (P.), pseudoclasper (P. c.), proximal flange (P. f.), paratergite 8 (Pt. 8), paratergite 9 (Pt. 9), sclerotized rod (R.), spine (S.), sternum 10 (S. 10), sclerite (Sc.), tubercle (T.), thecal shield (T. s.), theca (Th.).

Conspicuous pattern of alternating black and yellow squares along connexival margins visible beyond hemelytra in females (Fig. 19).

Male genitalia (Figs. 21–25). Ventral margin of pygophore broadly V-shaped with small emarginations at lateral extremities (Fig. 21); dorsal margin arched and bearing two large spines, one on each side of mid-line (Fig. 20). Proctiger box-like with a posterior lip. Claspers L-shaped, apically spatulate and serrate on inner surface, basally bearing a large rounded tubercle (Fig. 22). Theca well sclerotized, bearing laterally on each side a pair of small heavily sclerotized basal tubercles and a larger pair of anterior tubercles (Fig. 23); apical margin bearing a large thecal shield (Fig. 23). One pair of membranous conjunctival appendages present. Median penal lobes narrow leaf-like structures, apically acute, lying one on either side of S-shaped endophallic duct, basally fused by a cross bar around duct (Figs. 24, 25).

Female genitalia (Figs. 26–28). External genitalia plate-like (Fig. 26); paratergites 8 without spiracles; paratergites 9 oblong, lying widely separated on either side of second gonocoxae. Spermatheca typically consisting of a balloon-like dilation and apical spermathecal bulb (Fig. 27); latter bearing two finger-like processes, one short, the other longer and reaching proximal flange of pump (Fig. 28). Opening of spermathecal duct surrounded by a ring sclerite and a small U-shaped cap sclerite.

Type. Three specimens from P. R. Uhler's collection in the United States National Museum are identifiable as part of the syntype series. From these the following specimen is designated as the lectotype: ♀ S. Diego, Cal (segment 5 of left-antenna missing), United States National Museum, Washington. Paralectotypes: ♀ N.E. Col; ♀ Ks, 5, 80.

Distribution. Nebraska, Kansas, Colorado, Utah, Montana, Arizona, California, Nevada, Oregon, British Columbia.

Synonymy. The type of *H. eatoni* Bliven was not available for study. This name is placed in synonymy on the basis of the description and illustration of the pygophore.

Holcostethus limbolarius (Stål, 1872)

Peribalus limbolarius Stål, 1872, Svenska Vet.-Akad. Handl. 10(4), p. 34; Uhler, 1877, Bull. U.S. Geol. Survey 3, p. 403; Distant, 1880, Biologia Cent. Amer. Het. 1, p. 65, pl. 6, fig. 19; Van Duzee, 1894, Bul. Buf. Soc. Nat. Sci. 5, p. 171; Gillette and Baker, 1895, Hem. Colo., p. 16; Uhler, 1904, Proc. U.S. Nat. Mus. 27, p. 351; Van Duzee, 1904, Trans. Amer. Ent. Soc. 30, p. 32; Snow, 1906, Trans. Kan. Acad. Sci. 20(1), p. 177; Van Duzee, 1917, Cat. Hem., p. 33; Blatchley, 1926, Het. of E. N. Amer., p. 105; Froeschner, 1941, Amer. Mid. Nat. 26, p. 135; McDonald, 1966, Quaest. Ent. 2, pp. 18, 51 figs. 106–110, 469–470 (genitalia).

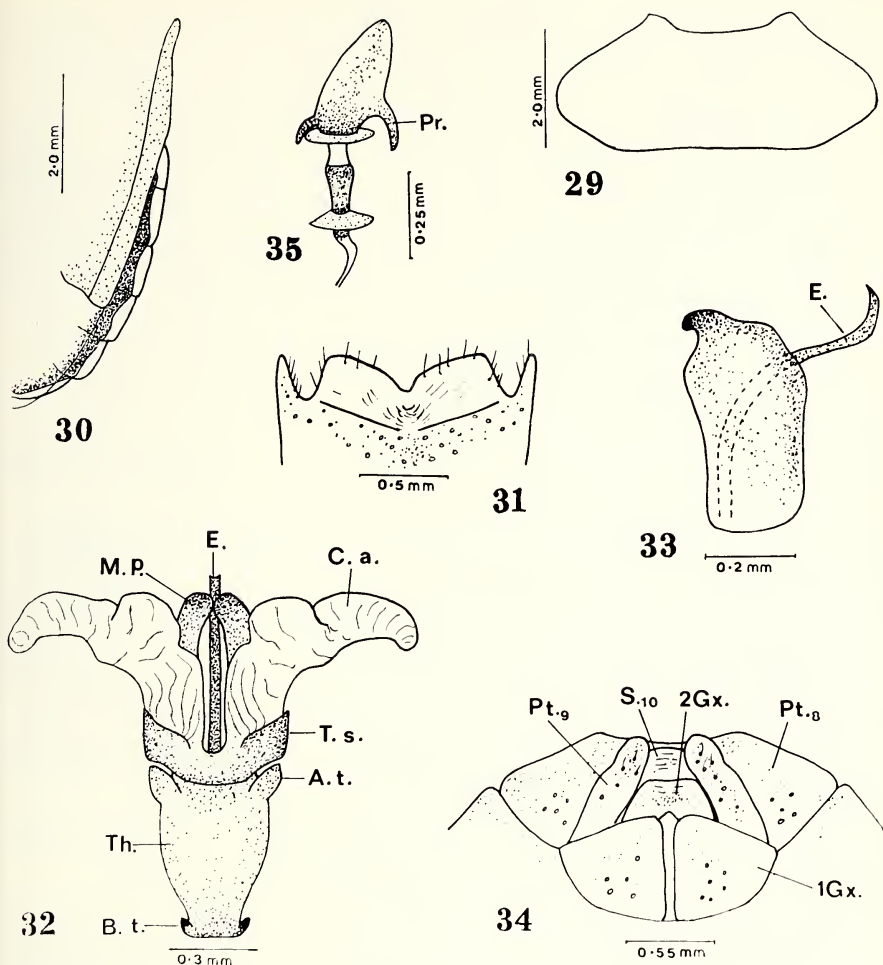
Holcostethus limbolarius Kirkaldy, 1909, Cat. Hem., p. 48.

Peribalus modestus Uhler, 1872, U.S. Geol. Surv. Mont., p. 396; Uhler, 1876, Bull. U.S. Geol. Surv. 1, p. 289.

Jugae meeting in front of tylus. Anterolateral margins of pronotum straight, sometimes slightly concave (Fig. 29). Anterior face of pronotum declivous. Connexiva with a continuous narrow yellow margin (Fig. 30).

Male genitalia (Figs. 31–33). Ventral margin of pygophore deeply incised on lateral extremities, less deeply incised medianly, forming two distinct oblong plates (Fig. 31). A pair of palmate pseudoclaspers present, these not observed in McDonald's (1966) description.

Remainder of male genitalia described by McDonald (1966) and Baker (1931).



FIGS. 29–35. *H. limbolarius*. 29. Pronotum. 30. Lateral margin of abdomen, dorsal view. 31. Ventral margin of pygophore. 32. Aedeagus, ventral view. 33. Right median penal lobe, lateral view. 34. Female genitalia. 35. Spermathecal bulb and pump, apical tubercle (A. t.), basal tubercle (B. t.), conjunctival appendage (C. a.), endophallic duct (E.), first gonocoxa (1 Gx.), second gonocoxa (2 Gx.), median penal lobe (M. p.), process (Pr.), paratergite 8 (Pt. 8), paratergite 9 (Pt. 9), sternum 10 (S. 10), thecal shield (T. s.), theca (Th.).

Female genitalia (Figs. 34, 35). Described by McDonald (1966).

Types. From the syntype series the following specimen is designated as the lectotype: No. 202 ♂ Texas, Belfrage, Naturhistoriska Riksmuseet, Stockholm. 13 remaining specimens are designated paralectotypes: 192 ♂ N. York, Belfrage; 193–4 ♂ Illinois, Belfrage; 195 ♂ N. York, Belfrage; 196–199 ♀ Texas, Belfrage; 200–1, 3 ♂ Texas, Belfrage;

204 ♀ Mexico, Doucard; 205 ♂ Mexico, Salle. Specimen 192 has a label Typus; 192, 193 have been labelled Paratypus and 195 Allotypus. None of these can be considered valid designations.

Distribution. Throughout U.S.A., southern Canada and northern Mexico.

Note. This species can be distinguished from *H. abbreviatus* by the following features: Anterolateral pronotal margins straight (convex in *H. abbreviatus* and impressed behind); connexiva with a continuous yellow margin (alternating black and yellow in *H. abbreviatus*); pygophore with no spines on dorsal margin (two present in *H. abbreviatus*); spermathecal bulb with one process not much longer than the other (Fig. 35) (in *H. abbreviatus* one process much longer, reaching proximal flange of pump (Fig. 28).

Holcostethus piceus (Dallas, 1851)

Pentatoma piceus Dallas, 1851, List. Hem. 1, p. 236.

Holcostethus piceus; Kirkaldy, 1909, Cat. Hem., p. 48.

Peribalus piceus; Gillette and Baker, 1895, Hem. Colo., p. 16; Van Duzee, 1904, Trans. Amer. Ent. Soc. 30, p. 34; Van Duzee, 1917, Cat. Hem., p. 33; Blatchley, 1926, Het. E. N. Amer., p. 106.

Dark brown species. Anterolateral margins of pronotum straight as in *P. limbolarius*, margined with yellow (Fig. 36). Narrow continuous pale yellow margin on connexiva.

Male genitalia. (Figs. 37-41). Ventral margin of pygophore deeply cleft centrally and with a shallow emargination laterally on either side (Fig. 38); dorsal margin smoothly arched (Fig. 37). Proctiger resembling that of *H. abbreviatus*, differing slightly in shape. Claspers similar to *H. tristis* but bearing a distinct keel on the outer arm (Fig. 39). Aedeagus similar to *H. tristis*; no apical tubercles on theca (Figs. 40, 41).

Female genitalia. (Figs. 42, 43). Similar to *H. tristis*; two processes on spermathecal bulb approximately same length (Fig. 43).

Type. *Holotype.* British Museum, Type No. HEM 970. ♀ Hudsons Bay. Type examined.

Distribution. Iowa, S. Dakota, Colorado, Montana, Illinois, Alberta, Ontario.

Note. This species can be distinguished from *H. tristis* by the distinct yellow tip of the scutellum, straight anterolateral pronotal margins (convex in *H. tristis*), lack of distinct flanges on the ventral margin of the pygophore (in *H. tristis* the flanges are impressed) and absence of anterior tubercles on the theca (present in *H. tristis*).

Holcostethus fulvipes (Ruckes, 1957)

Peribalus fulvipes Ruckes, 1957, Bull. Brook. Ent. Soc. 52, p. 39.

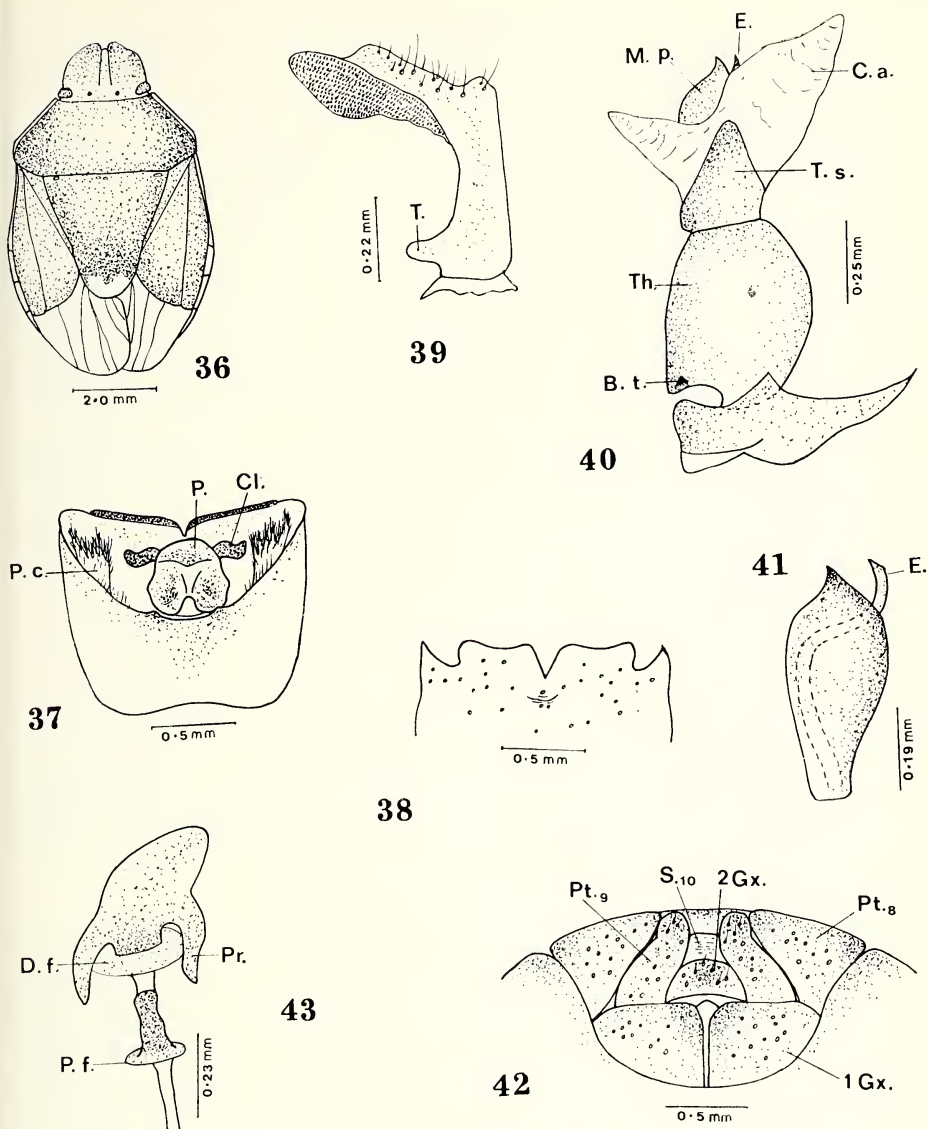
Holcostethus fulvipes. New Combination.

Reddish brown species. Jugae not meeting in front of tylus. Femora red or rosy. Abdominal sterna with distinct black, zig-zag markings in two parallel lines on each side of mid-line.

Male and Female genitalia. Identical to those of *H. abbreviatus*.

Type. *Holotype.* The American Museum of Natural History, ♂ Lake George, N. Y., J. L. Zabriskie, 22 Aug. 1893; Paratype, ♀ (same data as holotype). Type examined.

Distribution. New York, New Hampshire.



FIGS. 36–43. *H. piceus*. 36. Dorsal view. 37. Pygophore, dorsal view. 38. Ventral margin of pygophore. 39. Left clasper. 40. Aedeagus, lateral view. 41. Right median penal lobe, lateral view. 42. Female genitalia. 43. Spermathecal bulb and pump, basal tubercle (B. t.), conjunctival appendage (C. a.), clasper (Cl.), distal flange (D. f.), dorsal margin (D. m.), endophallic duct (E.), first gonocoxa (1 Gx.), second gonocoxa (2 Gx.), median penal lobe (M. p.), proctiger (P.), paratergite 8 (Pt. 8), paratergite 9 (Pt. 9), sternum 10 (S. 10), tubercle (T.), thecal shield (T. s.), theca (Th.).

Holcostethus tristis (Van Duzee, 1904)

Peribalus tristis Van Duzee, 1904, Trans. Amer. Ent. Soc. 30, p. 33; Van Duzee, 1917, Cat. Hem., p. 33.

Holcostethus tristis. New Combination.

Nearly unicolorous dark brown species with convex anterolateral margins of pronotum margined in lighter brown (Fig. 44). Alternating pattern of light brown or yellow and black squares along margins of connexiva.

Male genitalia (Figs. 45-48). Ventral margin of pygophore with a deep median notch and two smaller emarginations at lateral extremities (Fig. 46); dorsal margins evenly arched (Fig. 45). Claspers L-shaped; apex flattened on inner margin and bearing rows of minute serrations; base with a large prominent tubercle (Fig. 47). Theca heavily sclerotized; basal and apical tubercles present; apical margin produced into a thecal shield (Fig. 48). Conjunctival appendages membranous, bifid. Median penal lobes similar to *H. abbreviatus* but somewhat broader (Fig. 49).

Female genitalia. (Figs. 50, 51). Similar to *H. abbreviatus*. Usually two and sometimes three processes on spermathecal bulb (Figs. 50, 51).

Type. Lectotype. California Academy of Sciences, ♀ Vancouver Is., B.C., G. Taylor, 20 Aug. 1897. Type examined.

Distribution. California, Oregon, Washington, Idaho, Montana, British Columbia.

Holcostethus hirtus (Van Duzee, 1937)

Peribalus hirtus Van Duzee, 1937, Pan. Pacific Ent. 13, p. 25.

Holcostethus hirtus. New Combination.

Unicolorous dark brown species with long grey setae on dorsal and ventral surfaces. Anterolateral margins of pronotum convex. Connexiva with a continuous narrow lighter brown margin.

Male genitalia. No males available for examination.

Female genitalia. Similar to *H. abbreviatus*.

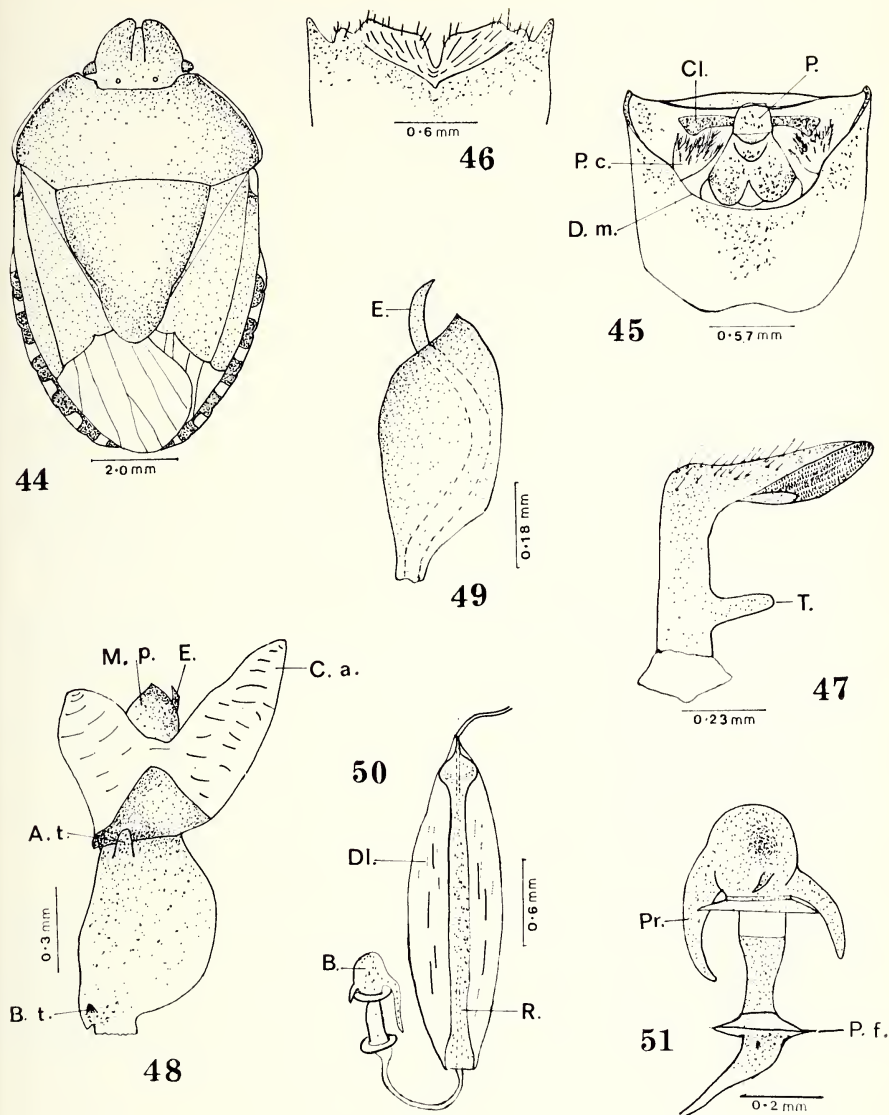
Note. This species resembles *H. tristis* but can be distinguished by the presence of long grey setae on the dorsal surface of the body and the narrow light brown margin of the abdominal connexiva (*H. tristis* has an alternating pattern of light brown and black squares).

Type. Holotype. California Academy of Sciences, ♀ Sequoia Nat. Pk., Calif. Alt. 3-5000 ft., Collector E. C. Van Dyke, 20 June 1929. Four paratypes, all ♀ (same data as holotype). Type examined.

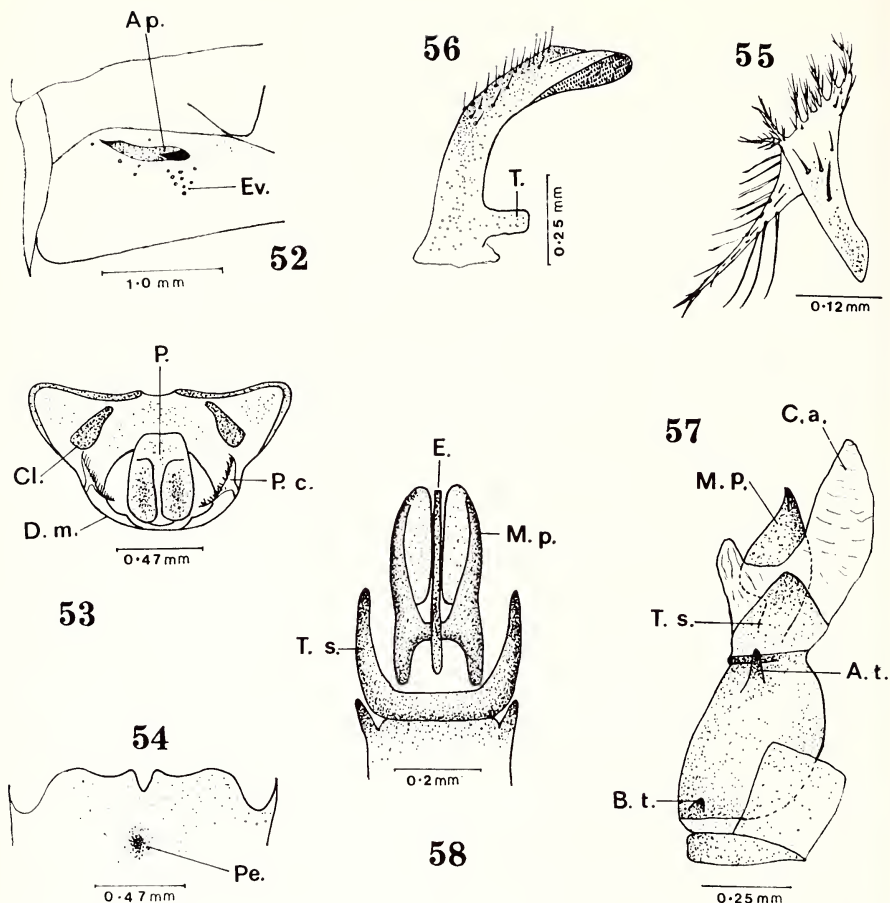
Distribution. California.

Holcostethus ruckesi n. sp.

Dark brown species; male 7 mm long (apex of head to tip of membrane) 4 mm wide (between lateral angles of pronotum); female 6.5-7.3 mm long; 3.8-4.0 mm wide. Entire dorsal surface heavily punctate. Jugae longer than tylus, broadly rounded and sometimes meeting apically. Antennae dark brown. Rostrum light to dark brown, apex reaching



FIGS. 44-51. *H. tristis*. 44. Dorsal view. 45. Pygophore. 46. Ventral margin of pygophore. 47. Left clasper. 48. Aedeagus, lateral view. 49. Left median penal lobe, lateral view. 50. Spermatheca. 51. Spermathecal bulb and pump, anterior tubercle (A. t.), spermathecal bulb (B.), basal tubercle (B. t.), conjunctival appendage (C. a.), clasper (Cl.), dorsal margin (D. m.), endophallic duct (E.), median penal lobe (M. p.), proctiger (P.), pseudoclasper (P. c.), proximal flange (P. f.), process (Pr.), sclerotized rod (R.), tubercle (T.).



FIGS. 52-58. *H. ruckesi* n. sp. 52. Metasternum. 53. Pygophore, dorsal view. 54. Ventral margin of pygophore. 55. Right pseudoclasper. 56. Right clasper. 57. Aedeagus, lateral view. 58. Aedeagus, ventral view, stink gland opening and sulcus (Ap.), apical tubercle (A. t.), basal tubercle (B. t.), conjunctival appendage (C. a.), clasper (Cl.), dorsal margin (D. m.), endophallic duct (E.), evaporative area (Ev.), median penal lobe (M. p.), proctiger (P.), pseudoclasper (P. c.), protuberance (Pe.), tubercle (T.), thecal shield (T. s.), theca (Th.).

hind coxae. Ventrolateral margins of pronotum brown or yellow, bowed out and submarginally impressed; pronotal disk rugose. Scutellum bluntly rounded apically, narrowing only slightly beyond frena. Coxae and trochanters amber, femora and tibiae dark brown, tarsi light brown. Metapleural stink gland openings with a long apically acute sulcus (Fig. 52). Evaporative area extending onto mesopleuron. Connexiva with alternating markings on sternal margins of abdomen, a median light brown streak on sterna 3-6.

Male genitalia (Figs. 53-58). Ventral margin of pygophore sinuate with median and lateral notches forming two plates (Fig. 54); a small protuberance present below median

notch; dorsal margin smoothly arched (Fig. 53). Pseudoclaspers small, elongate and brush like (Fig. 55). Claspers L-shaped; upper surface with a keel bearing a number of setae (Fig. 56); apex flattened and inner surface finely serrate; a large tubercle present on base. Theca bearing large apical and small basal tubercles (Fig. 57); apical margin produced into a thecal shield. Conjunctiva with one pair of appendages, these broadly bifid (Fig. 57). Median penal lobes leaf-like apically acute and basally fused by a cross bar (Fig. 58); endophallic duct lying between margins of median penal lobes and not extending beyond them.

Female genitalia. External genitalia and spermatheca similar to *H. limbolarius*.

Type. *Holotype*, ♂, Rustlers Park, Chiricahua Mts. Ariz. VII-30-55; P. D. Hurd Collector. Deposited in The American Museum of Natural History. Left antenna minus segment 4 and 5, right antenna minus segment 5; forelegs minus tarsomeres 2 and 3. *Paratypes*, 3 ♀s: Rustlers Park, Chiricahua Mts. Ariz. VII-1-55, P. D. Hurd Collector; Chirc. Mts. Ariz. 9-11-35, E. D. Ball; McMillan Camp, 13 miles, N. Silver City, Grant Co., New Mexico, July 18, 1961, 6800 ft., F., P. and J. Rindge (Deposited in The American Museum of Natural History); 1 ♀ Rustlers Pk., Ariz., Chiricahua Mts., Cochise Co., July 27, 1955 (Deposited with L. H. Holston, Louisiana State University).

Remarks. This species is named after the late Dr. Herbert Ruckes who originally noted it in The American Museum of Natural History Collections.

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